Reconstruction Objects & Flow
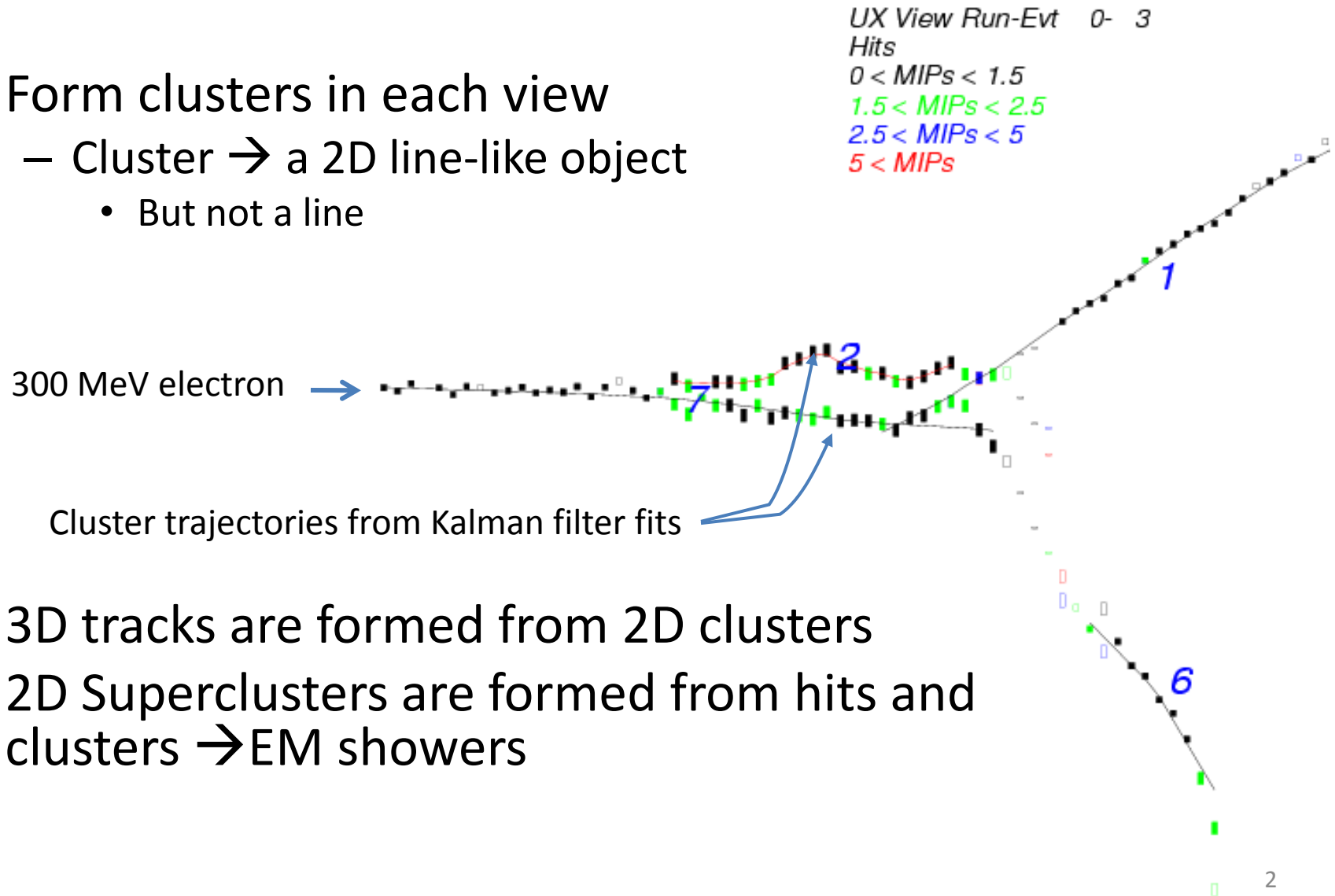## *Lessons learned from BB code*

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BB Reconstruction Nomenclature

- Form clusters in each view
  - Cluster → a 2D line-like object
    - But not a line
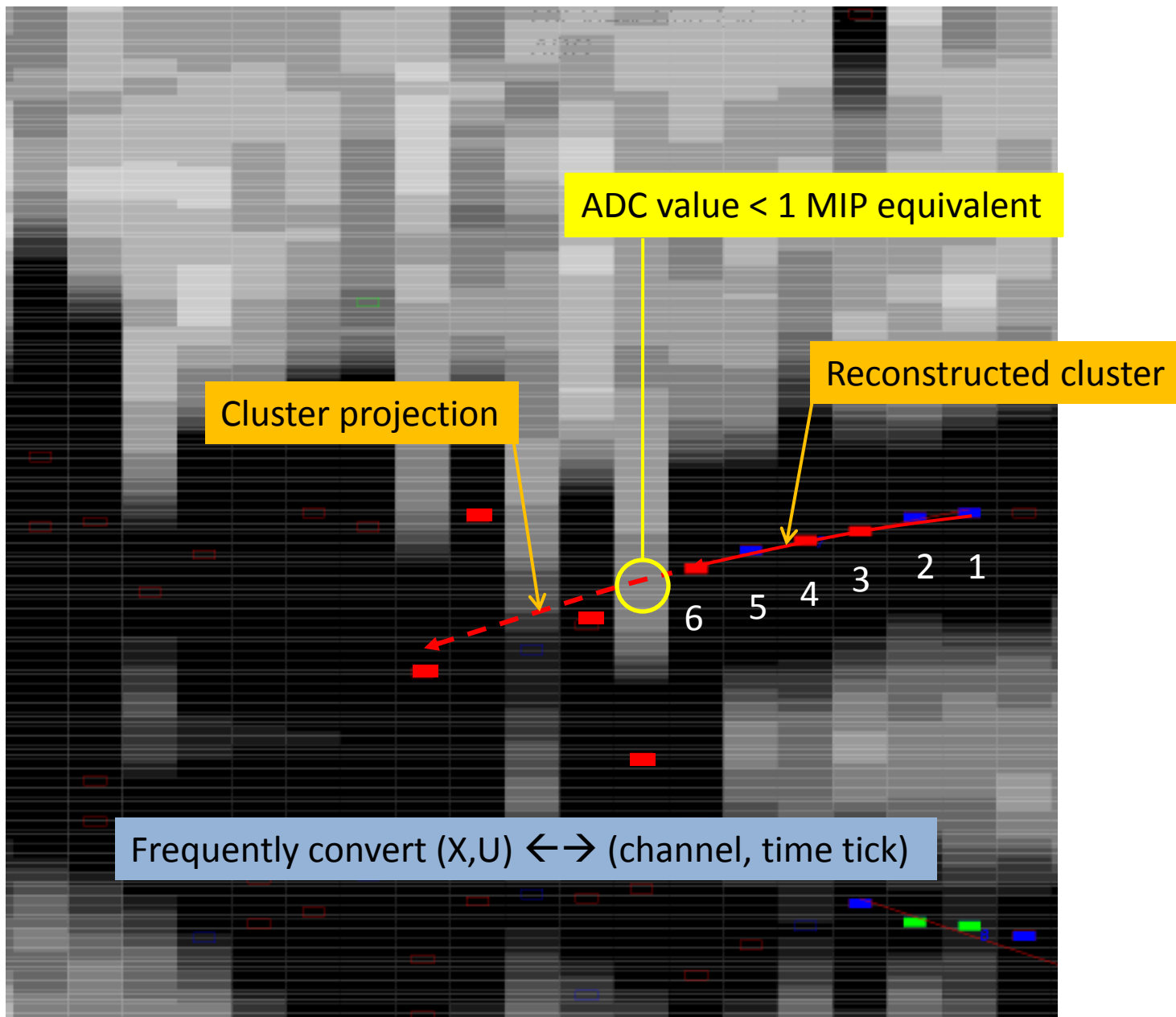
300 MeV electron →

Cluster trajectories from Kalman filter fits

UX View Run-Evt   0- 3
Hits
0 < MIPs < 1.5
1.5 < MIPs < 2.5
2.5 < MIPs < 5
5 < MIPs

- 3D tracks are formed from 2D clusters
- 2D Superclusters are formed from hits and clusters →EM showers

2

Reconstruction Flow - 1

- Reconstruct high momentum clusters first
  - Start with "downstream" hits and work upstream
  - Require hits to have the same angle flag ($\rightarrow$ same hit template) as the hits used in the cluster
  - Require hits to have similar MIP equivalents to the hits used in the cluster
  - Require that ADC channel/time bins between the hits exceed that expected for 1 MIP
    - Allows "swimming through" messy areas (track pileup, 2ndry ints) where hit reconstruction failed
    - Prevents reconstructing unphysical clusters
  - Use tight cuts w/o MCS corrections
  - Fit 20 most upstream hits of the cluster
    - Allows for gentle curvature of high momentum tracks

Example on next slide

ADC value < 1 MIP equivalent

Reconstructed cluster

Cluster projection

6 5 4 3 2 1

Frequently convert (X,U) ←→ (channel, time tick)

Reconstruction Flow - 2

- Reconstruct low momentum clusters next
  - Start with "downstream" hits and work upstream
  - Require hits with Δ (angle flag) < 2
  - Require similar MIP equivalent & consistent ADC pulse height
  - Reconstruct seed cluster of >9 hits with loose χ^2 cut
  - Pass cluster finding control to Kalman filter tracking code
    - Incorporates MCS errors in cluster finding/fitting
   - Provides a momentum hint (really need 3D trk)

Cluster Class

- Cluster origin: U_o, X_o
- Cluster direction cosines: cu, cx
  - Not slope!
- Errors on origin and direction cosines
- Number of hits, fit χ^2
- Lower/central/upper momentum estimate
- Flag word to identify the cluster algorithm that created this cluster (debugging tool)
- Vector of hits
  - Allow for multiple hits/wire (I didn't)
  - Hits should be sorted by distance from the cluster origin
  - Do not allow multiple clusters to share the same hit

The hit class should include a hit $\rightarrow$ cluster pointer for faster searching for unused hits

Cluster Trajectory

- Cluster line fit parameters are only reasonable for the first N hits where N ~ 1/momentum

- I define several (temporary) cluster trajectories composed of the estimated cluster position X, δX at every wire

10 wires   10 wires
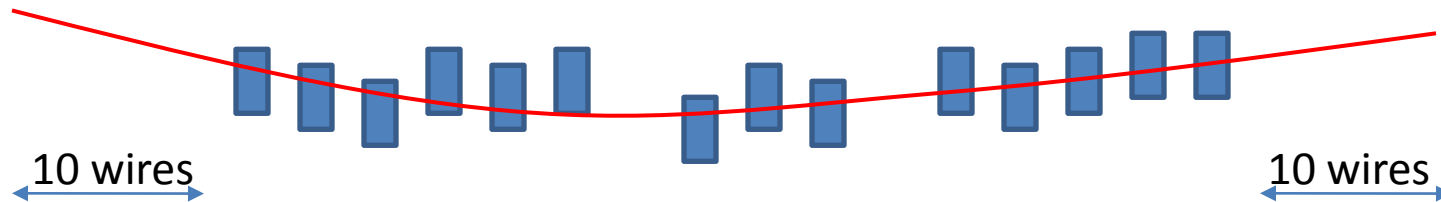
- Trajectories are used by cluster merging algorithms and in the event display

- This is a bad choice for tracks traveling parallel to the drift direction – needs some thought